Aug3123

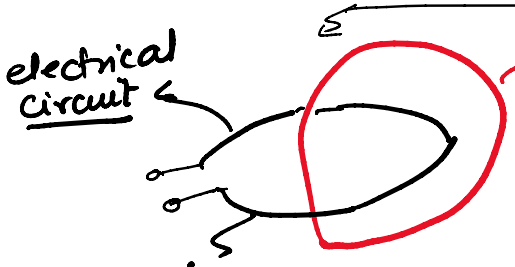
Thursday, August 31, 2023 5:51 PM

Todays : Modelling and Control of Separately excited DC Motors

1. Modelling electromagnetic systems.
2. Dynamics & Statics.
3. Separately excited DC Motor.

Key electromagnetic concepts

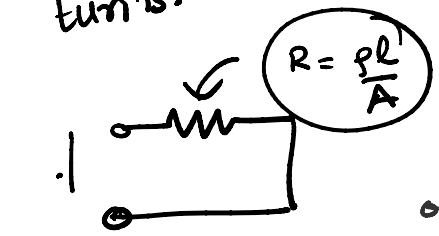
1. Flux linkage → Faraday's law
   ↳ Lorentz force.



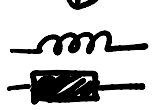
→ Link

Flux linkage. $= N\phi = Li = \psi$ (psi)

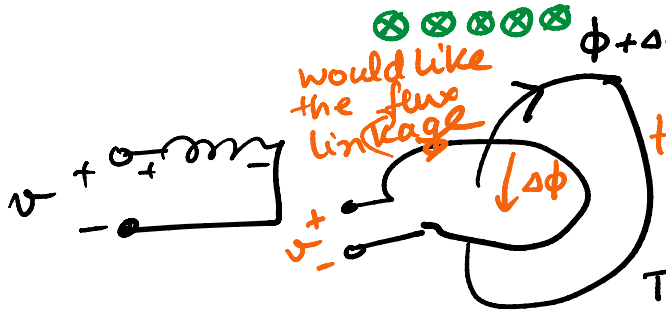
electromagnetic phenomenon. ↑ inductance ↓



electrical circuit →



Faradays law



$$v = \frac{d\psi}{dt}$$

ψ flux linkage.

$\frac{d}{dt}$ ← rate of change.

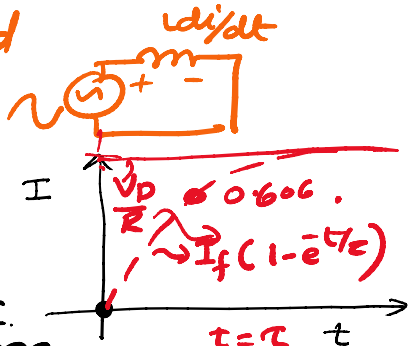
Transformer induced voltage current or voltage which producing the flux change with time

rate change of ψ →

Dynamically induced voltage --

EMF

back-emf



$t = 0-$ $I_a = 0$

$t = 0+$ $I = 0$

ODE

asymtotic

$\therefore V_D = L\frac{dI}{} + RI$

ODE

$\therefore V_D = L\frac{dI}{dt} + RI$

Greek homogenous

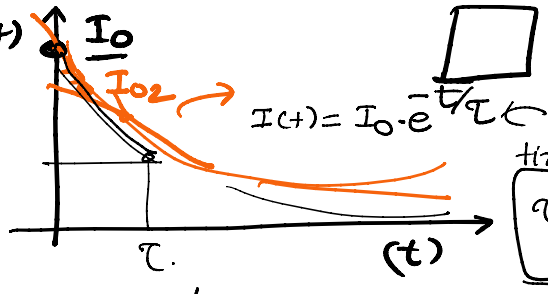
$L\frac{dI}{dt} + RI = 0$ - - -

$\frac{dI}{dt} = -I.\frac{R}{L}$

Suppose $I_0 = I_1$

I_0

slope of I



time constant

$\tau = \frac{L}{R}$

$t = \tau$

$e^{-1} = 0.3606$.

Final value ~ $5 * 6 \times \tau$

First order system.

How do I find L, R

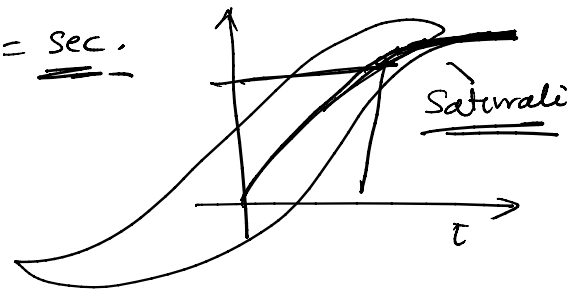
$T = \tau = \frac{L}{R}$ - sec.

$v = L.\frac{d\psi}{dt}$ $\quad R = \frac{\text{Volt}}{\text{Amp.}}$ $\quad \frac{L_f}{R_f}$ $\quad \frac{L_a}{R_a}$.

$\therefore \frac{v.dt}{d\psi} = L$

$\frac{L}{R} = \frac{\text{Volt.sec/Amp}}{\text{Volt./Amp}} = \text{sec.}$

$\frac{\text{Volt.sec}}{\text{Amp.}}$



$L \propto N^2$

$\propto N^2$

Large L_f R_f Large

L_a R_a

small ~ I_a ↗ Large.

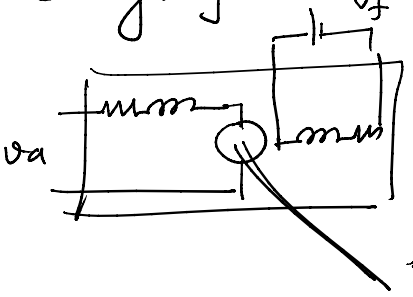
few ms → 10 ms

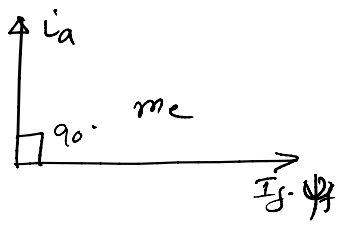
Large

100 - 1000 ms

Change Torque fast by changing ?? I_a.

change I_a by changing V_a.





~ Const

$M_e = K_f I_f I_a$

$M_e = K.I_a$.